$$+\cot^2\frac{\pi}{2n}\log\left(\frac{1+\sin\frac{\pi}{2n}}{\cos\frac{\pi}{2n}}\right)\Big].$$

COROLLARY. If $a=1$, $n=2$, then

$$M=\frac{2-\sqrt{2}}{3}+\log(1+\sqrt{2}).$$

Also solved by *G. B. M. ZERR*, and *HENRY HEATON*.

MISCELLANEOUS.

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90. Proposed by DR. E. D. ROE, Jr., Syracuse University, Syracuse, N. Y.

I shot my rifle at different ranges and found the following table of elevations e, for the vernier peep sight, for the given distances s:

s	e
0	21.0
100	24 5
200	28.5
300	33.5
400	40.0
500	48 5

The distances are measured in yards. How shall a table of elevations be constructed, giving the arguments e, for every five yards up to 500 yards? Do not give the whole table, but explain the method, and illustrate by giving a computation, carrying the result to three places of decimals. An actual problem.

Solution by the PROPOSER.

The solution of this problem, which is doubtless somewhat arbitrary, was as follows: We have partly given and partly implied in the data, the following scheme:

s	0	100	200	300	400	500
e	21.0	24.5	28.5	33.5	40.0	48.5
Δe	3.5	4.0	5.0	6.5	8.5	
$\Delta^2 e$	0.5	1.0	1.5	2 0		
$\Delta^3 e$	0.5	0.5	0.5			
$\Delta^4 e$	0	0				

In this we notice that the fourth and third differences are constant, while the second are in arithmetical progression. Assuming that we have discovered the law, we may extend the second, third and fourth differences up to the column under 400, and thus have the complete data for interpolation by means of the method of finite differences. According to this method, if e_s denote the elevation for the distance s, we have,

$$e_{y\times100+(x/20)\times100}=e_{100y+5x}=e_{100y}+\frac{x}{20}\frac{\Delta e}{1\,!}100y+\frac{x}{20}\left(\frac{x}{20}-1\right)\frac{\Delta^2 e}{2\,!}100y$$

$$+\frac{x}{20}\left(\frac{x}{20}-1\right)\left(\frac{x}{20}-2\right)\frac{\Delta^3 e_{100y}}{2\,!},$$

where $y=0$, 1, 2, 3, 4.

$x=1$, 2, ...19. As the complete solution, and giving the 95 values sought.

Example: It is required to find e_{425}. Here $y=4$, $x=5$, and $e_{400}=40$, $\Delta e_{400}=8.5$, $\Delta^2 e_{400}=2.5$, $\Delta^3 e_{400}=0.5$, $\Delta^4 e_{400}=0$. Hence

$$e_{425}=40+\frac{1}{4}\,8.5+\frac{1}{4}\left(\frac{1}{4}-1\right)\frac{2.5}{2\,!}+\frac{1}{4}\left(\frac{1}{4}-1\right)\left(\frac{1}{4}-2\right)\frac{0.5}{3\,!}$$

$$=40+2.125-0.234+0.027=41.918.$$

Remark: With a table like this satisfactory results in hunting may be obtained. The table is contained in a small note book. But the style of hunting must be changed. Longer distances must be used, and the work resolves itself into judging distances, and variations in the wind, setting elevation and wind guage sights, accurate sighting and firm arm holding of the rifle.

Also solved by *G. B. M. ZERR*.

PROBLEMS FOR SOLUTION.

ARITHMETIC.

144. Proposed by B. F. FINKEL, A. M., M. Sc., Professor of Mathematics and Physics in Drury College, Springfield, Mo.

A hired a house for one year for $300; at the end of four months he takes in M as a partner; and at the end of eight months he takes in P. At the end of the year what rent must each pay? [From Greenleaf's *National Arithmetic*, page 442.]

145. Proposed by B. F. FINKEL, A. M., M. Sc., Professor of Mathematics and Physics in Drury College, Springfield, Mo.

By discounting a note at 20% per annum, I get 22½% per annum interest; how long does the note run? [From Ray's *Higher Arithmetic*, page 405.]

⁂ Solutions of these problems should be sent to B. F. Finkel not later than July 10.

ALGEBRA.

136. Proposed by JOHN M. COLAW, A. M., Monterey, Va.

Solve $a^{x^2}b^{y^2}=c$......(1), and $c^{x+y}=ab$......(2).

137. Proposed by MARCUS BAKER, U. S. Geological Survey, Washington, D. C.

Solve, if possible, $a^x+b^x=c$.